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ABSTRACT

This document outlines the second part of a two-part senior high school general science course designed to familiarize students with genetics, ecology, biological science, physical science, and atmospheric conditions. Included are listings of adopted texts, performance objectives, course outline, laboratory investigations, reports and projects, discussion questions, films, references, and a master reference sheet. (SL)

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CONCEPTS AND APPLICATIONS OF SCIENCE II

122934
SCIENCE

Written by John Mayer and Bettie Lou McCollum
for the
DIVISION OF INSTRUCTION
Dade County Public Schools
Miami, Fla.
1976

SE 021 416

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CONCEPTS AND APPLICATIONS OF SCIENCE II

COURSE DESCRIPTION:

This course is designed to identify and familiarize students with major concepts and applications of biological, physical, and earth sciences. The areas to be covered are basic genetics, ecology, elementary chemistry, basic fundamental principles of matter and energy, earth structure and movement, atmospheric conditions, introductory astronomy and interpretation of data.

ENROLLMENT GUIDELINES

This quin is the second part of two quin courses prepared to provide a strong background in general science for the serious academic students who have completed four quins of science in senior high school and who also need a wider base in scientific knowledge.

STATE ADOPTED TEXTS

Oram, Raymond F.,et al. Biology: Living Systems. Columbus, Ohio: Charles E. Merrill Publishing Co., 1973.

Kaskel, Albert,et al. Laboratory Biology - Investigating Living Systems. Columbus, Ohio: Charles E. Merrill Publishing Co., 1973.

Biological Sciences Curriculum Study. Biological Science: An Inquiry Into Life. New York: Harcourt Brace Javanovich, Inc., 1973.

Brown, Walter R. and Anderson, Norman D. Physical Science: A Search For Understanding. Philadelphia: J. B. Lippincott Company, 1972.

Tracy, George R.,et al. Modern Physical Science. New York: Holt, Rinehart and Winston, Inc., 1974.

Gerfin, Richard. Laboratory Investications for Modern Physical Science. New York: Holt, Rinehart, and Winston, 1974.

Otto, James H.,et al. Modern Biology. New York: Holt, Rinehart and Winston, Inc., 1973.

Namowitz, Samuel and Stone, Donald B. Earth Science. The World We Live In. New York: American Book Company, 1975.

Namowitz, Samuel and Stone, Donald B. Activities in Earth Sciences. New York: American Book Company, 1975.

Bishop, Margaret,et al. Focus on Earth Science. Columbus, Ohio: Charles E. Merrill, 1976.

Bishop, Margaret and Lewis, Phyllis. Earth Science: A Learning Strategy for the Laboratory. Columbus, Ohio: Charles E. Merrill, 1976.

Lavoroni, Charles W.,et al., Water Pollution. Menlo Park, California: Addison-Wesley Publishing Co., 1971.

Lavoroni, Charles W.,et al., Air Pollution. Menlo Park, California: Addison-Wesley Publishing Co., 1971.

Lavoroni, Charles W.,et al., Noise Pollution. Menlo Park, California: Addison-Wesley Publishing Co., 1971.

PERFORMANCE OBJECTIVES

The student will:

1. explain the causes of tides, currents, and waves.
2. given a list of dangerous marine animals, describe their effects upon humans and the necessary first aid treatment.
3. given five common local marine plants and animals, match their common name to a list of scientific names.
4. identify three species of mangrove from specimens and cite their economic importance and ecological importance to the environment.
5. use the tide tables to predict local high and low tides for one week.
6. using a drawing, indicate the various life zones in the sea and list three types of plants and animals that can be found in each zone.
7. list the effects of pollution on tide water plants and animals.
8. list causes of severe atmospheric disturbances.
9. given proper information on a weather map, predict the weather for the following 24 hours.
10. list probable dire circumstances which may result from changing the amount of ozone in the upper atmosphere.
11. list modern weather forecasting equipment and describe the use of each type of equipment.
12. describe the effect of the earth's movement on weather and climate of several regions of the earth.
13. solve simple problems of time using the 24 hour clock.
14. state and explain the two components of the cell theory.
15. diagram, label and describe the functions of organelles in a typical cell.
16. describe the functions of the cell nucleus.
17. Compare and contrast the processes of mitosis and meiosis.
18. describe the structure and replication of DNA and relate this information to the processes of mitosis and meiosis.
19. explain: "One gene - one enzyme hypothesis."

20. solve problems in genetics resulting in typical phenotypic and genotypic ratios from specific crosses.

21. apply the rules of probability to solve problems involving sex-linked traits.

22. describe some abnormalities in man that are caused by non-disjunction of chromosomes.

23. explain the way heredity and environment operate together in guiding the development of an organism.

24. identify sources of pollution in the local community and suggest changes which could result in decreased pollution.

25. compare and contrast biological control of insects and chemical pest control.

26. identify ways that man's influence on the earth's eco-system has become important because of his increasing numbers and his increasing ability to alter the natural ecosystem.

27. given a list of natural resources, identify those resources that are under most conditions, easily renewable, moderately renewable and, for all practical purposes, nonrenewable.

28. suggest positive actions that can be taken to solve problems concerning the following: food, waste, increased population and natural resources.

29. label a diagram of a typical wave by indicating the wavelength, crest, trough, and amplitude.

30. compare the speed of sound in air to the speed of sound in water and steel, and suggest reasons for the differences in speed.

31. state three ways in which light may be produced.

32. plan, in writing, an efficient lighting program for their home considering illumination, efficiency of light sources, and costs of the program.

33. recognize from a list of velocities, the speed of light in the metric system and English system.

34. describe magnetism as a force related to distance from source, material of source, and molecular structure of the source.

35. describe electrostatics in terms of similar and dissimilar charges, charging by contact and induction, and the hazards of static electricity.

36. describe an electric current in terms of volts, and amps, and will solve simple problems using Ohm's Law.

COURSE OUTLINE

I. Marine Science

(A) The Hydrologic Cycle

(B) Composition of Ocean Water

(C) Life in the Oceans

(D) Tides and Waves

(E) Local Currents

(F) Economic Importance

(G) Recreational Importance

II. Meteorology

(A) Atmospheric Pressure and Winds

(B) Air Masses and Fronts

(C) Storms, Weather Forecasts and Maps

(D) Factors that Control Climate

(E) Climates of the World

(F) Clouds, Precipitation, and Colors in the Sky

(G) Smog and Air Pollution

III. The Cell

(A) Cell Theory

(B) Parts of a typical cell

IV. Reproduction: The Cell

(A) Mitosis

(B) Meiosis

(C) Role of DNA

V. Genetics

(A) Phenotypic and genotypic ratios

(B) Probability

(C) Nondisjunction

(D) Heredity and environment

VI. Man and His Environment

(A) Pollution

1. Air
2. Water
3. Soil
4. Noise

(B) Human Population and Conservation of Resources

1. Population explosion
2. Renewable resources
3. Nonrenewable resources
4. Positive action

VII. Physical Science

(A) Heat

(B) Light

(C) Sound

(D) Electricity

(E) Magnetism

LABORATORY INVESTIGATIONS

Namowitz, Samuel. Activities in Earth Science. New York: American Book Company, 1975.

1. Three Studies in Oceanography #45 p. 155
2. Sea Water vs. Fresh Water #46 p. 157
3. Contour of the Ocean Floor #47 p. 159
4. Ocean Currents of the World #48 p. 162
5. Draw a Profile from a Contour Map #19 p. 55
6. Absorption and Radiation of Energy: Land and Water #36 p. 119
7. The Meaning and Development of a Temperature Inversion #38 p. 127
8. Finding the Dew Point and Relative Humidity by Experiment #41 p. 1
9. Recording and Correlating Weather Elements #43 p. 147
10. Hurricane Weather #43 p. 147
11. Reading the Station Model on a Weather Map #44 p. 151

Kaskel, Albert and others. Laboratory Biology: Investigating Living Systems. Columbus, Ohio: Charles E. Merrill, 1973.

12. Lab #10 The Basic Unit of Life (Part 1)
13. Lab #11 The Basic Unit of Life (Part 2)
14. Lab #24 Mitosis
15. Lab #25 Time for Mitosis
16. Lab #34 DNA and RNA
17. Lab #27 Genotype and Phenotype Numbers Using One Trait
18. Lab #30 Pedigree Studies
19. Lab #33 Sex-Linked or Not Sex-Linked?
20. Lab #28 Phenotype Ratios With Two Traits

Biological Sciences Curriculum Study. Biological Science - An Inquiry Into Life. New York: Harcourt Brace Javanovich, Inc., 1973.

21. Inquiry 3-2 Cells of Living Plants (pp. 61-63)
22. Inquiry 3-3 Cells from You and Frogs (p. 65)
23. Inquiry 7-1 Mitosis and Genetic Continuity

Lavoroni, Charles W., et al. Noise Pollution. Menlo Park, California: Addison-Wesley Publishing Co., 1971.

24. Chapter 3, "Investigating Noise Pollution" (Many investigations related to noise pollution)

Lavoroni, Charles W., et al. Air Pollution. Menlo Park, California: Addison-Wesley Publishing Co., 1971.

25. Chapter 3, "Investigating Air Pollution" (Many investigations related to air pollution)

Lavoroni, Charles W.,et al. Water Pollution. Menlo Park, California: Addison-Wesley Publishing Co., 1971

26. Chapter 3, "Investigating Water Pollution" (Many investigations related to water pollution)

Gerfin, Richard. Laboratory Investigations for Modern Physical Science. New York: Holt, Rinehart, and Winston, Inc. 1974.

27. The Meaning of Heat p. 99
28. Measuring Heat p. 102
29. Properties of Waves p. 105
30. Light and Matter p. 119
31. Electricity and Magnetism p. 134

REPORTS AND PROJECTS

1. Energy from the Gulf Stream.
2. Mariculture.
3. Breeding Salt Water Fish.
4. Value of the Mangrove ... the Florida Keys.
5. Commercial Fishing in Florida.
6. What Causes Water Spouts?
7. Can Lightning be Controlled?
8. Energy from the Wind.
9. Economic Importance of Weather Forecasting.
10. Ozone Controversy
11. Investigate how a particular cell is similar and dissimilar to the generalized cell described in textbooks.
12. Prepare a report on the DNA molecule. Include in the report an explanation of the statement: "DNA makes DNA, but RNA makes protein."
13. List several examples of variations among organisms. Choose one characteristic and explain how a variation in this trait might be important in terms of a possible change in environment.
14. Report on one of the following topics:

    (a) lethal genes
    (b) multiple alleles
    (c) sex linkage

15. Prepare a project to demonstrate how the laws of probability are used in genetics.
16. Report on the way heredity and environment operate together in guiding the development of an organism.
17. Tour your community. Write down the locations of pollution you believe are taking place. Discuss the results with your class.
18. Write a report on one of the following:

    (a) Environmental Protection Agency's work to unite different federal agencies in the fight against air and water pollution.
    (b) The Clean Air Act of 1970 (controls for automobile and industrial pollution.)

(c) The 1970 Federal Water Pollution Control Act (sets fines for oil companies if they spill into the seas - controls dumping wastes into streams.)
(d) State of Oregon's ban on non-returnable bottles (1971).
(e) Investigate the psychological studies concerning the effect of noise on the following: street accidents, decreased work efficiency, irritability caused by inability to control noise.

19. Plan a debate on one of the following controversial issues:

(a) Nuclear plants are safe and clean.
(b) Our planet is infected with people. We must curb our procreation voluntarily or Nature will curb it in some other way.
(c) The energy crisis is a case of manufactured hysteria brought about by government and poorly informed environmentalists.

20. Write a story about man in the year 2050 assuming the problems of pollution are not solved.

21. Write a report on population growth throughout the world. Which countries seem to face the most severe problems?

22. Prepare a list of the harmful aspects of chemical pest control, and a similar list of beneficial aspects. With this information in mind, prepare either an argument that defends the use of pesticides or one that recommends discontinuing their use.

23. Report on the major sources of man-made air pollution. Include in your report the following: carbon dioxide, sulfur dioxide, carbon monoxide, oxides of nitrogen and photochemical air pollution.

24. Contact your nearest State Water Pollution Control Agency. Find out the following: (a) What is the major water pollution problem in your state? (b) What is the major water problem in your community?

25. Prepare a report on the physical effects of noise on the quality of human life.

26. Compare the efficiency ratings of various types of engines.

27. Are lightning rods worth the investment?

28. Can light be bent?

29. Measure the noise level of your environment in decibels.

30. Compare various heating and cooling systems used in Dade County.

DISCUSSION QUESTIONS

1. Compare the ions in fresh water to those in salt water and suggest reasons for the differences.

2. Discuss the importance of mangroves to the marine environment.

3. Why should we protect Biscayne Bay from further pollution of all sort?

4. Why do we think that life began in the sea?

5. Compare the New England coastline with the Florida coastline and suggest reasons for the differences in the type of coastline.

6. Can climate be related to the history of civilizations? If so, how?

7. When do temperature inversions occur? What can be done about them?

8. What importance does accurate weather forecasting have on activities of people?

9. Compare methods used in forecasting weather in the 1940's with the methods used today.

10. Does weather have a psychological effect on people?

11. Describe the relationship between the structures in the cell and their functions.

12. Explain the concept of the cell theory:

    a. The cell is the basic unit of structure and function of all organisms.
    b. All cells are produced from other cells.

13. Contrast <u>mitosis</u> and <u>cytokinesis</u>.

14. Explain the statement: Mitosis ensures that each daughter cell has the same number and kinds of chromosomes as the parent cell.

15. Explain the statement: Meiosis results in two cells having the monoploid number of chromosomes.

16. Explain the following statement: The genetic code is determined by the sequence of base pairs in a DNA molecule.

17. Describe the technique of X-ray diffraction. How was it used to analyze DNA?

18. What evidence is there that for every enzyme present in a cell, there is a gene responsible for its existence?

19. Work problems in groups and present results to the class on the following inherited traits: eye color, blood type, and tongue-rolling.

20. Work problems in groups and present results to the class on the following sex-linked traits: color blindness and hemophilia.

21. Discuss the following abnormalities in man that are the result of nondisjunction: Down's Syndrone, Turner's Syndrone and Klinefelter's Syndrone.

22. Discuss the ways that heredity and environment operate together in guiding the development of an organism. Include the following in the discussion: size of the individual, I. Q., achievement and health.

23. Natural resources can be described as either renewable or nonrenewable. Identify the resources that fall into each category and explain why.

24. Identify the leading pollutants found in the air, water, and soil. What are the primary causes of these pollutants? Suggest ways that these conditions can be changed.

25. Describe the ways that overpopulation can affect the quality of life in a country.

26. Consider the effects of noise on your life throughout the day. Is there a difference between noise and sounds?

27. Use important points of individual reports (written or oral) to summarize positive actions that can be taken to improve ways to decrease waste, develop new food resources, control the size of the population and change life styles.

28. Chapter 4, Noise Pollution includes 52 questions that can be used for class discussion.

29. Chapter 4, Air Pollution includes 58 questions that can be used for class discussion.

30. Chapter 4, Water Pollution includes 89 questions that can be used for class discussion.

31. What forces can be felt at some distance away from the force?

32. What is mechanical advantage? How does this concept apply to simple machines?

33. Name three ways in which light is produced?

34. What makes an airplane fly? Compare propeller driven aircraft to jet aircraft.

35. Describe three ways in which heat can be transferred from place to place.

FILMS

1. The Unchained Goddess, Part I
   AV# 1-30382, 33'C

2. The Unchained Goddess, Part II
   AV# 1-30384, 33'C

3. Winds and Their Causes
   AV# 1-02113, 10'BW

4. Reading Weather Maps
   AV# 1-10995, 14'BW

5. Clouds Above
   AV# 1-02135, 9'C

6. Tides of Fundy
   AV# 1-11275, 15'

7. The Sea
   AV# 1-31381, 27'

8. Ocean Currents
   AV# 1-13128, 17'

9. Oceanography - Science of the Sea
   AV# 1-05972 15'

10. Cell Biology-Mitosis and DNA
    AV# 1-13773, 16',B

11. Cell Biology-Structure and Composition
    AV# 1-13812, 14'C

12. Cell Division-The Basis of Growth in All Living Things
    AV# 1-02236, 11',B

13. Living Cell, The: An Introduction
    AV# 1-14484, 20',C

14. Cell, The Structural Unit of Life
    AV# 1-02231, 11'

15. DNA - A Molecule of Heredity
    AV# 1-11078, 16',C

16. Chromosomes of Man, The
    AV# 1-11827, 21',B

17. Genetics - Human Heredity
    AV# 1-13806, 16',C

18. Heredity and Environment
    AV# 1-02226, 11'

19. Pollution
AV# 1-14497, 14',C

20. Energy: Can't Do Without It
AV# 1-14325, 14',C

21. Energy: Choices, Options and Decisions
AV# 1-14454, 15',C

22. Energy Sources of the Future
AV# 1-14324, 15',C

23. Man's Effect on the Environment
AV# 1-14238, 14'C

24. House of Man, Part 2 - Our Crowded Environment
AV# 1-05872, 11',C

25. Jobs in Atomic Energy
AV# 1-01927, 13'BW

26. Radiation in Biology
AV# 1-11101, 14'C

27. Work, Time, and Power
AV# 1-10666, 14'C

28. Electromagnetic Induction
AV# 1-10776, 14'BW

29. Electrostatic Charges and Forces
AV# 1-10754, 14'BW

30. Colour
AV# 1-11582, 15'C

31. Speed of Light
AV# 1-10734, 21'BW

FILMSTRIPS

Ward's Natural Science Estab., 1966

1. DNA and Cell Chemistry (6 filmstrips with teacher's guide)

   (a) Carbon, Key Atom in Living Organisms
   (b) Proteins, Prime Molecules of Life
   (c) DNA, Structure and Replication
   (d) DNA And Protein Synthesis
   (e) DNA And RNA, Evidence For Structure And Function
   (f) DNA And Cell Chemistry

Eyegate House, 1971

2. Introduction to Genetics (6 filmstrips with 3 cassettes)

   (a) Mendelian Genetics
   (b) Population Genetics
   (c) DNA, RNA, and Mutation
   (d) Sex Determination, Linkage and Influences
   (two other filmstrips are optional)

Warren Schloat Productions, Inc., 1972

3. Air Pollution (2 filmstrips with cassettes)

New York Times Co., 1970

4. Crisis of The Environment (5 filmstrips with records)

   (a) Man An Endangered Species
   (b) Breaking The Biological Strand
   (c) Vanishing Species
   (d) Preserve And Protect
   (e) Population Explosion

Dade County School Board, 1970

South Florida Environmental Science Media Units (filmstrips, tapes, teacher notebook and test slides)

5. Unit II - South Florida Fresh Water Biology, AV# 3-60035
   Water Pollution (A video tape) AV# 7-10383

6. Unit XI - South Florida Biology, AV# 3-60044
   Pesticides in South Florida (A video tape) AV#7-10389
   Too Many Decibels (A video tape) AV# 7-10393

REFERENCES

1. Andrews, William,et al., A Guide to the Study of Terrestrial Ecology. Englewood Cliffs, New Jersey: Prentice Hall, Inc. 1974.

2. American Geological Institute. Investigating the Earth. Boston: Houghton Mifflin Company, 1976.

3. Biological Sciences Curriculum Study. Biological Science: An Inquiry Into Life. New York: Harcourt Brace Jovanovich, Inc., 1973.

4. Biological Sciences Curriculum Study. Biological Sciences Molecules to Man. New York: Houghton Mifflin Company, 1968.

5. Bishop, Margaret and Lewis, Phyllis. Earth Science: A Learning for the Laboratory. Columbus, Ohio: Charles E. Merrill, 1976.

6. Bishop,Margaret,et al., Focus on Earth Science. Columbus, Ohio: Charles E. Merrill, 1976.

7. Brandwein, Paul F. et al., The Earth: Its Living Things. New York: Harcourt Brace Jovanovich, Inc., 1970.

8. Brown, Walter R. and Anderson, Norman D. Physical Science: A Search for Understanding. Philadelphia: J. B. Lippincott Company, 1972.

9. Eisler, Sanford E. and Stock, Murray. Using Line Graphs. New York: Cambridge Book Company, 1972.

10. Kaskel, Albert,et al., Laboratory Biology - Investigating Living Systems. Columbus, Ohio: Charles E. Merrill Publishing Co., 1973.

11. Namowitz, Samuel and Stone, Donald B. Activities in Earth Sciences. New York: American Book Company, 1975.

12. Namowitz, Samuel and Stone, Donald B. Earth Science. The World We Live In. New York: American Book Company, 1975.

13. Oram, Raymond F.,et al., Biology: Living Systems. Columbus, Ohio: Charles E. Merrill Publishing Co., 1973.

14. Otto, James H.,et al., Modern Biology. New York: Holt, Rinehart and Winston, Inc., 1973.

15. Tracy, George R.,et al., Modern Physical Science. New York: Holt, Rinehart and Winston, Inc., 1974.

16. Weinberg, Stanley L. Biology: An Inquiry Into Life. Boston: Allyn Bacon, Inc., 1974.

MASTER SHEET - CONCEPTS AND APPLICATIONS OF SCIENCE II

Objectives	Texts	Lab.	Suppl. Refs.	Films	Film-strips	Reports Projects	Discuss. Quest.
1	6-Ch. 21	1		6			
2	7-Ch. 4	2		7		1	
3						2	1
4	7-Ch. 4	3				3	2
5	6-Ch. 22	4				4	3
6	7-Ch. 3	5		8		5	4
7	7-Ch. 3			9		6	5
8						6,7	7
9	6-Ch. 38	10		3		9	8,9
10	6-Ch. 39	9		1,2			10
		11		4			
11				7			
12	7-Ch. 2	7		8		10,8	
13	6-Ch. 32	8					6
	7-Ch. 2						
	6-Ch. 23						
14	1-Ch. 4	12,13		13,14	3	11	12
15	2-Ch. 3,6	21,22		11			11
16	6-Ch. 4,5			12			13
17	1-Ch. 7	14,15		10,14	10,12		14,15
18	2-Ch. 7	16,23			1,4	12	16,17
	1-Ch. 10						
	6-Ch. 7						
	2-Ch. 28						
19	1-Ch. 10	17,18		15	2	12	18
20	1-Ch. 8	19,20		16,17		15	19
21	2-Ch. 27,28					14	20
	5-Ch. 11						
22	1-Ch 8		16,17			14,25	21
23	2-Ch. 28		18			13,16	22
24	5-Ch. 11	24,25,26			3	17,18	24
25	8,9,10		1			22	
	5-pp. 820-22						
	2-Ch. 35						
26	2-p. 818-19					20,21,22	25,26
27	2-p. 809	24,25,26	7-Ch. 22		4	23,24,25	11,23
28	2-Ch. 35					18,19	27,28
							29,30
29	7-Ch. 4	29,28					
30	4-Ch. 28	27					
31	4-Ch. 28	30		30		28	24
34	4-Ch. 34			27			
35	4-Ch. 31	31		29,28		27	
36	4-Ch. 32						